GZA
GeoEnvironmental, Inc.

Engineers and Scientists

June 1, 2009
GZA File No. 12.0075892.00

Mr. Karl Manger
Jacobs Engineering Group, Inc
299 Madison Avenue
Morristown, NJ 07962

RE: Geotechnical Engineering Report
Proposed Parking Lot
168-354 Frontage Road
Newark, New Jersey

Dear Mr. Manger:

GZA GeoEnvironmental, Inc. (GZA) is pleased to submit this report to Jacobs Engineering Group, Inc (Jacobs) and the New Jersey Department of Property Management and Construction. It includes our findings, conclusions and recommendations related to the design and construction of pavement subgrades for the proposed parking lot to be located at 168-354 Frontage Road in City of Newark, New Jersey; see Figure 1. This report is subject to the Limitations set forth in Appendix A and the Terms and Conditions of our agreement.

55 Lane Road, Suite 407
Fairfield, NJ 07004
TEL: 973-256-7800
FAX: 973-256-8053
http://www.gza.com

BACKGROUND

Our understanding of the project is based on our recent work at the site and the following plan:

- A plan of the proposed site conditions entitled "Conceptual Layout 'A'" prepared by Jacobs Engineering Group, Inc. dated March 27, 2009.

Existing Conditions

GZA understands that the Site is located at 168-354 Frontage Road in Newark, New Jersey (Tax Block 5088, Lot 158). The site is currently vacant and portions of the ground surface are covered by grass, gravel, and overgrown vegetation; a large, up to approximately 7 feet high soil stockpile is located along the eastern portion of the site; two manholes are located along the northern portion of the site; a PSE&G gas line runs along the northern potion of the property immediately adjacent to the site; overhead electric lines also run along the northern portion of the site.

A Subsidiary of GZA GeoEnvironmental Technologies, Inc.

The site is bounded to the north by a railroad tracks and marshland, to the south by Frontage Road and New Jersey Department of Correction (NJDOC) prison warehouse, to the west by a 2-story NJDOC Northern State Prison Facility, and to the east by a 10-story Hotel and Conference facility. The majority of the site is relatively flat except the eastern portion where above-mentioned soil stockpile was observed. The site topography is relatively flat and approximate ground surface elevation (el.) is 16 feet.

Proposed Development

We understand the proposed development is to consist of a paved parking lot having entrance and exit from Frontage Road. The proposed parking lot is to have a gross footprint of approximately 6.1 acres and shall accommodate up to 300 cars on a daily basis. Other improvements will include stormwater management, security fencing and site lighting.

SCOPE OF WORK

GZA performed the following scope of work:

- Planned, coordinated and observed an exploration program consisting of five test borings.
- Reviewed available information, performed engineering analyses and developed pavement design and construction recommendations.
- Prepared this geotechnical engineering report containing our findings and recommendations.

REVIEW OF AVAILABLE INFORMATION

We reviewed available regional geologic information, the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps, USGS Maps, and available aerial photographs. Pertinent information obtained from these documents is summarized in the following paragraphs.

Surficial Geology

GZA reviewed New Jersey Geological Survey, Surficial Geology of the Elizabeth Quadrangle, Essex, Hudson, and Union Counties, New Jersey. Based on our review the project site is underlain by Artificial Fill, which is comprised of artificially emplaced sand, gravel, silt, clay, rock, cinders, ash, brick, concrete, wood, slag, metal, glass, and trash, overlaying Estuarine and Salt-Marsh Deposits consisting of organic silt and clay, and peat, with some sand and fine gravel.

Flood Data Research

The Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map titled "Essex County, New Jersey, (All Jurisdictions)" community panel number 34013C0158F, effective date June 4, 2007 indicates that the site is located outside the 100-year flood plain.

Aerial Photographs and Topography

We obtained and reviewed aerial photographs dated 1931, 1954, 1966, 1970, 1979, 1987, 1995, 2002 and 2006. The aerial photographs indicate wetlands at the current site location

from 1931 to 1966. In 1966, the Site appears to be filled. From 1966 to 2006, the photographs indicate the Site as vacant. GZA obtained and reviewed United States Geologic Survey (USGS) 7.5 Minute Topographic Quadrangle Map, Elizabeth, New Jersey dated 1981; the Site elevation was identified varying between an approximate elevations (el.) 16 ft and el. 23 ft above mean sea level.

FIELD SUBSURFACE INVESTIGATION

The soil borings were drilled in accordance with our proposal to obtain subsurface information in the proposed parking lot area. The subsurface investigation was completed under the full time inspection of a field engineer from our office under the direct supervision of our project Professional Engineer. Our field engineer prepared logs of the borings, classified soil, and obtained representative material samples. Boring logs are provided in Appendix B. One Call was contacted to mark out existing underground utilities for the site prior to beginning the field work.

Five (5) borings were drilled on April 22 and April 23, 2009 by Warren George, Inc. using a truck-mounted drill rig and mud-rotary technique. The borings were advanced depths ranging from 32 ft to 42 ft below existing ground surface. Surface elevations were inferred from United States Geologic Survey (USGS) 7.5 Minute Topographic Quadrangle Map, Elizabeth, New Jersey dated 1981.

A standard 2-inch O. D. split spoon sampler was used to obtain samples of the underlying soil strata. The Standard Penetration Tests (SPT)[1] performed according to ASTM D1586, were conducted as part of the sampling procedure, and the SPT results were recorded by our inspecting engineer. Ground water levels were recorded where first encountered. All boreholes were subsequently backfilled upon completion using drill cuttings. Soil samples were visually examined in the field, and classifications were confirmed by re-examination in our Fairfield, New Jersey office.

SUBSURFACE FINDINGS

Based on our borings, subsurface conditions below the site indicate successive layers of gravel and/or topsoil, fill, peat, sand, and silt and/or clay.

The gravel and/or topsoil layer is typically two to four inches thick. Below the topsoil fill stratum was encountered. The fill layer is approximately 15 feet to 20 feet thick, brown to dark brown, typically medium dense to dense, and consists of fine to medium sands with varying portions of silt, clay, and fragments of glass, plastic, wood, concrete, brick.

The peat layer was encountered below the fill in four borings. The peat layer is approximately 0.5 feet to 5 feet thick, dark brown to gray, typically soft to medium and consists of varying portions of fibers.

[1] The Standard Penetration Test (SPT) is a measure of the soil density and consistency. In accordance with ASTM D1586 the SPT N-value is defined as the number of blows required to drive a 2-inch O.D. split-barrel sampler 12 inches, after an initial penetration of 6 inches using a 140 pound safety hammer falling freely for 30 inches.

The sand stratum was encountered below the peat layer in three borings. The sand layer is approximately 5 feet to 15 feet thick, light brown to reddish brown, typically medium dense to dense, and consists of fine to medium sands with varying proportions of silt.

The silt or clay stratums were encountered below the sand layer in two borings. The silt and/or clay layers are approximately 7 feet thick, reddish brown, stiff to hard, with varying portions of fine to medium sands.

The subsurface conditions are shown in the boring logs included in Appendix B. The boring location plan is shown on Figure 2. The subsurface profile is shown on Figure 3.

Groundwater

Based on direct measurements from the borings drilled during this investigation, we observed the groundwater to be 3.5 feet to 15 feet below the ground surface, which corresponds to elevations (el.) ranging from 1 ft to 12.5 ft, at that time. It should be noted that fluctuations in groundwater levels will occur due to variations in season, rainfall, site features and other factors different from those existing at the time of the explorations and measurements.

Geotechnical Laboratory Testing

GZA determined from the observed conditions and available site grading information that laboratory soil tests were not needed to assist with the identification of the soil and the evaluation of engineering properties.

RECOMMENDATIONS

The design and construction recommendations presented below are based on our evaluation of the available subsurface data and our understanding of the proposed development. These recommendations are subject to the limitations in Appendix A.

GZA's recommendations are as follows:

Pavement

- Based on the information provided by Jacobs relatively light traffic (less than 300 cars per day) is anticipated; and consequently we recommend the following pavement cross-sections for new proposed parking areas and access road.

Layer	Minimum Thicknesses
Finish Course	2 inches
Binder Course	2 inches
Sand-Gravel Base Course	7 inches

- The existing fill stratum is suitable for use as a new pavement subgrade after compaction as described below for the preparation of the site subgrade.
- Refer to the Construction Recommendations section of this report for further detail.
- Where site grades are not raised and the subgrade preparation procedures recommended below are followed, we expect pavement settlements would be less than ½ inch.
- In the areas where up to 2 feet of fill is proposed to be placed, considerable pavement surface settlement can be anticipated. Because no site grade increase was contemplated at the time of the subsurface investigation, undisturbed soil samples were not collected and no soil consolidation tests were conducted. At this point we empirically estimate that 6 inches of total fill-induced pavement surface settlements is possible within 20 years after the parking lot construction. This is an approximate value and the actual settlement could vary significantly either upwards or downwards. GZA recommends additional subsurface investigation in order to evaluate potential settlement more precisely.

Liquefaction

Due to the density of the predominantly granular fill material and based on our analysis, liquefaction of saturated soils resulting from a seismic event is considered unlikely.

Lightpoles

Lightpoles are proposed throughout the parking lot area. The existing fill will be suitable to provide adequate support of typical drilled in relatively shallow concrete pier foundations. The foundation installation work should be observed and approved by a qualified geotechnical engineer. Any soft soils encountered during compaction should be removed.

The proposed light pole type, construction means and methods, and supporting design calculations, signed and sealed by a professional engineer licensed in the State of New Jersey, should be submitted for review and approval by the Owner and the Geotechnical and/or Structural Engineer.

Drilled in concrete piers should be designed using a soil having a moist unit weight of 120 lbs/ft^3 and a minimum drained angle of internal friction of 30°. A pier should be pre-drilled to the required depth and diameter. The pre-drilled space should be filled with concrete having minimum compressive strength of 3,000 lbs/in^3 up to proposed top of the pier elevation. Because the proposed grades increase lightpole foundations will settle over time and periodic re-leveling of the poles may be required.

CONSTRUCTION RECOMMENDATIONS

Site Clearing

Prior to commencement of the proposed construction any miscellaneous trash, debris, or other unsuitable materials should be removed from the site. Clearing and grubbing of all vegetation and trees (including assorted root systems) designated for removal should be performed, and

the materials disposed off site in accordance with applicable regulations. Clearing activities should be performed in accordance with an approved sedimentation and erosion control or equivalent plan prepared for this project. Topsoil should be stripped from the proposed development area, stockpiled and protected from erosion. The topsoil can be re-used in future landscaped areas.

Remains of old utilities (if any), and associated utility structures which conflict with proposed construction should be completely removed. All construction work should be performed so as not to disturb any active structures or utilities. Protection of these elements should be provided as necessary during the course of the construction at the site.

Pavement Subgrade Preparation

- The existing fill at proposed pavement base course elevation may remain in place, provided the subgrade appears dense and stable after proof-compaction with at least six passes of a vibratory drum roller (with a minimum static drum weight of 10,000 pounds).
- Weak or soft spots identified during proof-compaction should be over-excavated and replaced with compacted Structural Fill as requested by inspecting geotechnical engineer.

Reuse of On-Site Materials

Some of the on-site soil that is present at depths anticipated to be encountered during construction activities may be suitable for use as select fill in landscaped areas. It should be laboratory tested (i.e. modified proctor test, grain size distribution analysis, and chemical contamination evaluation) prior to construction to confirm its suitability.

Materials and Placement

Recommended gradations for fill materials are provided in Table 1. Use of ¾-inch Crushed Stone, in lieu of soil fill, at the bottom of excavations may aid in dewatering operations (if required). Crushed Stone should be placed in lifts no greater than 12 inches in thickness, with each lift compacted to an unyielding surface.

The recommended minimum degree of compaction for on-site or off-site soils used as Structural Fill, based on percentage of maximum dry density as defined by ASTM D-1557 Method C, is specified below for different areas.

Fill Area	Percent of Maximum Dry Density
Pavement and Slab Base Course	95
Below Pavement Base Course	92
Beneath Landscape Areas	90

All fill should be placed and compacted in accordance with Table 2.

Protect subgrades from frost and debris at all times during construction. Rainwater, snow, ice or trash/debris should not be allowed to accumulate in the subgrade areas. Fill should not be placed over frozen soil.

Site Grading

To meet the proposed finished grade elevations, placement of approximately 2 feet of additional fill will be required within the proposed parking lot area. The greatest depths of fill should be completed first. Fill placement should be conducted in uniform horizontal lifts and compacted as discussed in the preceding section of this report.

Due to the relatively light loading and the engineering characteristics of the soil materials used as compacted fill, we expect the majority of any elastic settlement to occur during construction. We empirically estimate fill-induced settlements due to consolidation of the existing compressible materials to be on the order of 6 inches. This is an approximate value and the actual settlement could vary significantly either upwards or downwards. Factors such as fill height and peat/clay layer thickness underneath the existing grades will significantly influence total settlement and differential movement of the finished pavement grade. GZA recommends additional subsurface investigation to access probable frequency of the maintenance work and better evaluate potential settlement.

Because considerable ground surface settlements are expected within the proposed parking lot area, the new asphalt pavement could crack and periodic maintenance work (i.e. repaving) will be required.

Utilities

Excavations will be required for the installation or relocation/removal of utilities and associated structures. All excavations should be properly sloped and/or braced in conformance with applicable OSHA regulations including, but not limited to, temporary shoring, utilizing trench boxes and/or proper benching.

We expect the majority of site utility excavations to be constructed in compacted fills. Prior to utility installations, exposed utility trenches in soil or fill should be proofrolled with at least six overlapping coverages of a double-drum walk-behind vibratory compactor such as a Bomag BW75 or equivalent. Any soft or unstable areas identified by the proofrolling should be removed and replaced with compacted fill. Backfill in utility excavations should meet the previously discussed requirements for engineered fill, with fill placement and compaction performed as previously discussed.

Water Control

Based on the boring and water level data, we expect the majority of the work will be above groundwater level. Some of the utility excavations could encounter water. Dewatering of collected storm runoff and water seepage into excavations is expected to be handled by

conventional sump pumping. The pumping, handling, and discharge of all dewatering effluent should be performed in accordance with all applicable regulations and any environmental requirements for the site.

Quality Control

The pavement subgrade design recommendations given in this report should be included on the project drawings. Our firm should be provided with and review any contractor submittals for conformance with the recommendations given in this report, and the project Construction Documents.

All pavement subgrades shall be inspected by a qualified geotechnical engineer. This work includes evaluation and verification of suitable bearing materials and compaction. This inspection is critical to verify the recommendations in this report and as shown on the Structural Plans are properly implemented in the field.

Qualified and experienced field personnel are needed to facilitate timely and satisfactory completion of the work. The following construction tasks should be observed and tested by a qualified geotechnical engineer engaged by the Owner using appropriate laboratory and field testing support:

- Supply and compaction of select fill
- Compaction of in-place soil.

The geotechnical engineer should also review the excavation and dewatering plans and procedures.

A critical part of this program is qualified engineering inspection during construction. Our firm is fully qualified to perform the necessary full-time observation of the site preparation and foundation construction work since we are familiar with the site conditions, proposed development, and the required site preparation and foundation design intent.

LIMITATIONS

The conclusions and recommendations given in this report represent our best engineering judgment based on currently available project information. Recommendations given are contingent upon one another and no recommendation should be followed independent of the others. This report has been prepared to assist the Structural Engineer in their design. It is intended for use with regard to the given information and any changes in structures, locations, or loading should be brought to our attention so that we may determine how such changes may affect our recommendations. The recommendations presented in this letter are subject to geotechnical limitations provided in Appendix A. We should review the parking lot drawings once they are finalized so we can confirm or modify, if necessary, the recommendations provided herein.

CLOSURE

This report gives our site preparation and pavement design recommendations. Since construction is the finalization of design, controlled inspection of the site preparation and pavement construction is necessary to verify the required minimum bearing materials are obtained in the field, and to identify field conditions that may warrant modifications to the recommendations given in this report.

A qualified geotechnical engineer should observe and provide field testing support during construction. As previously discussed, we suggest our firm be engaged during the construction phase of this development, including the engineering observation / monitoring / testing of the geotechnical related work during construction. Our continued involvement will assure proper and timely implementation of our recommendations, and to maintain the continuity of our responsibility of this project.

We trust these recommendations will allow you to complete your design and implement construction of the proposed parking lot.

Very truly yours,
GZA GeoEnvironmental, Inc.

Giorgi Khiladzeishvili, P.E
NJ Professional Engineer License No: 24GE04591200
Project Manager

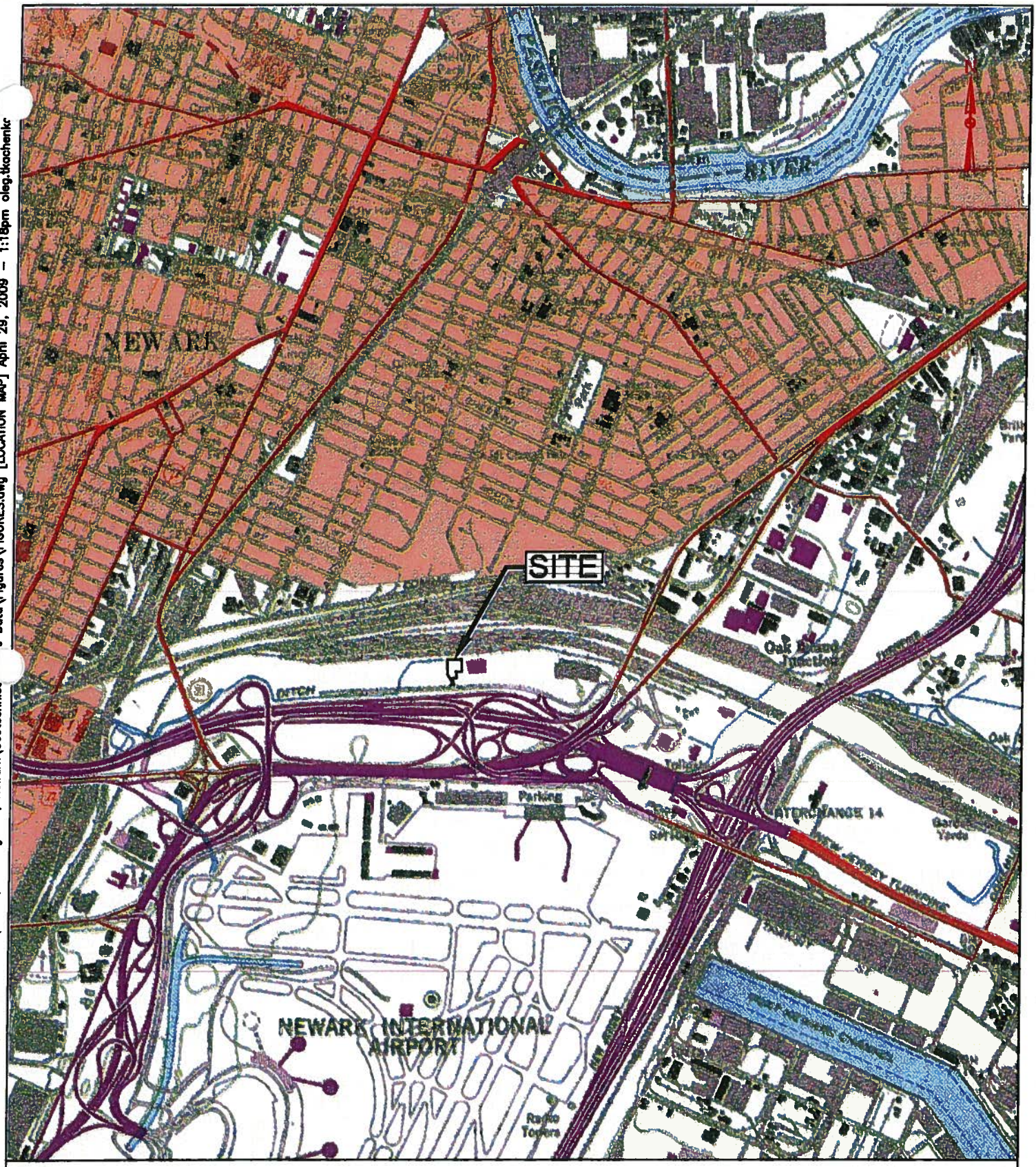
Benjamin Alter
Principal In Charge

Dennis Rubin
Consultant / Reviewer

Attachments:
Table 1 – Recommended Use and Gradation Criteria for Fill Materials
Table 2 – Compaction Methods
Figure 1 - Location Map
Figure 2 - Location Plan
Figure 3 - Subsurface Profile
Appendix A – Geotechnical Limitations
Appendix B - Boring Logs

A

FIGURES



SOURCE: USGS TOPOGRAPHIC MAP: ELIZABETH QUADRANGLE, NJ-NY, 1967 (PHOTOREVISED 1981)

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
55 LANE ROAD, 4TH FLOOR
FAIRFIELD, NEW JERSEY 07004
(973) 774-3300

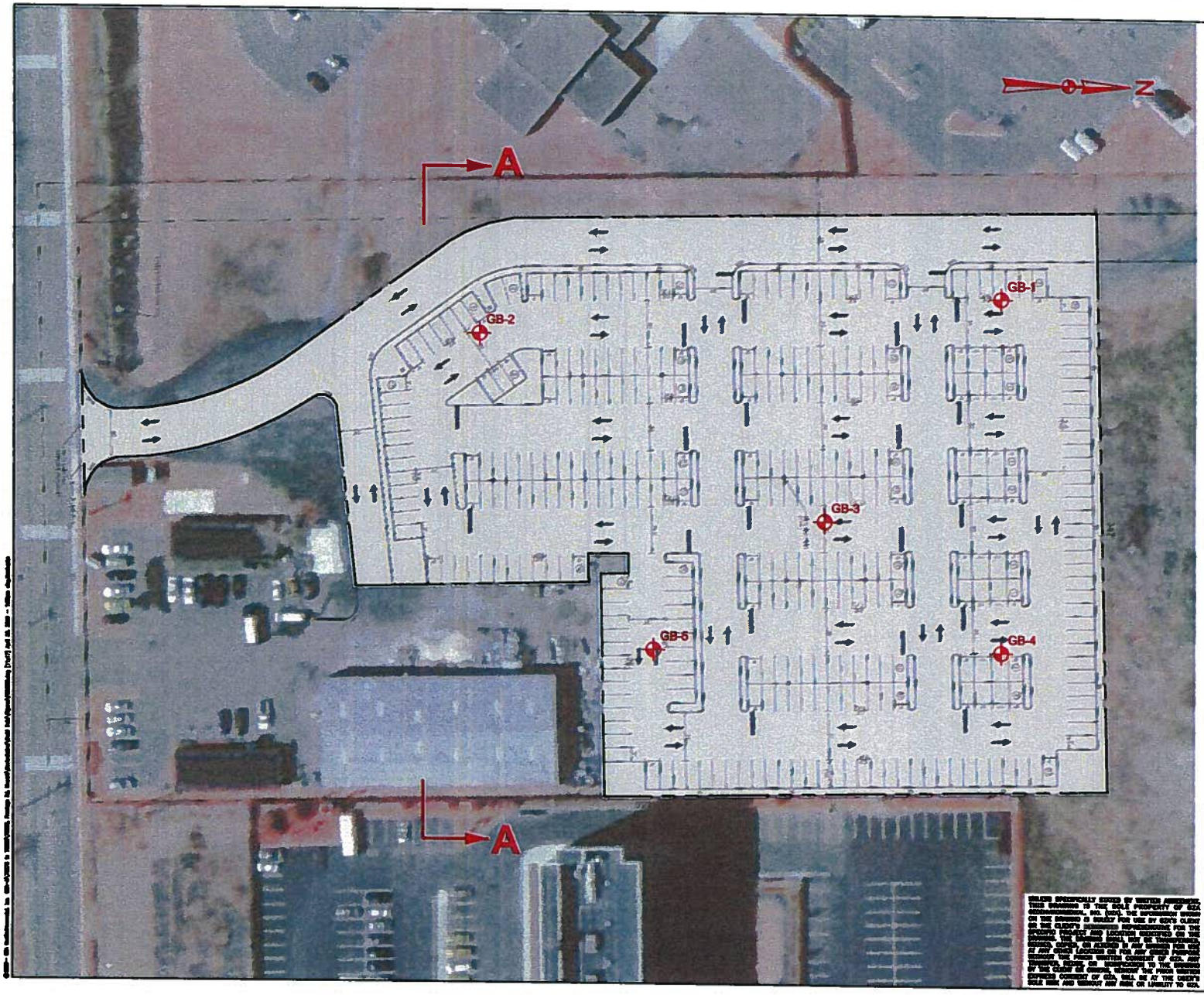
PREPARED FOR:
JACOBS ENGINEERING GROUP, INC

PROPOSED PARKING LOT
168-354 FRONTAGE ROAD, NEWARK, NEW JERSEY

LOCATION MAP

FIGURE NO.
1

PROJ MGR: GK	REVIEWED BY: GK	CHECKED BY: GK	DATE	PROJECT NO.	REVISION NO.
DESIGNED BY:	DRAWN BY: OVT	SCALE: 1"=2000'	5/4/2009	12.0075892.00	



LEGEND

GB-1 GZA BORING

NOTES

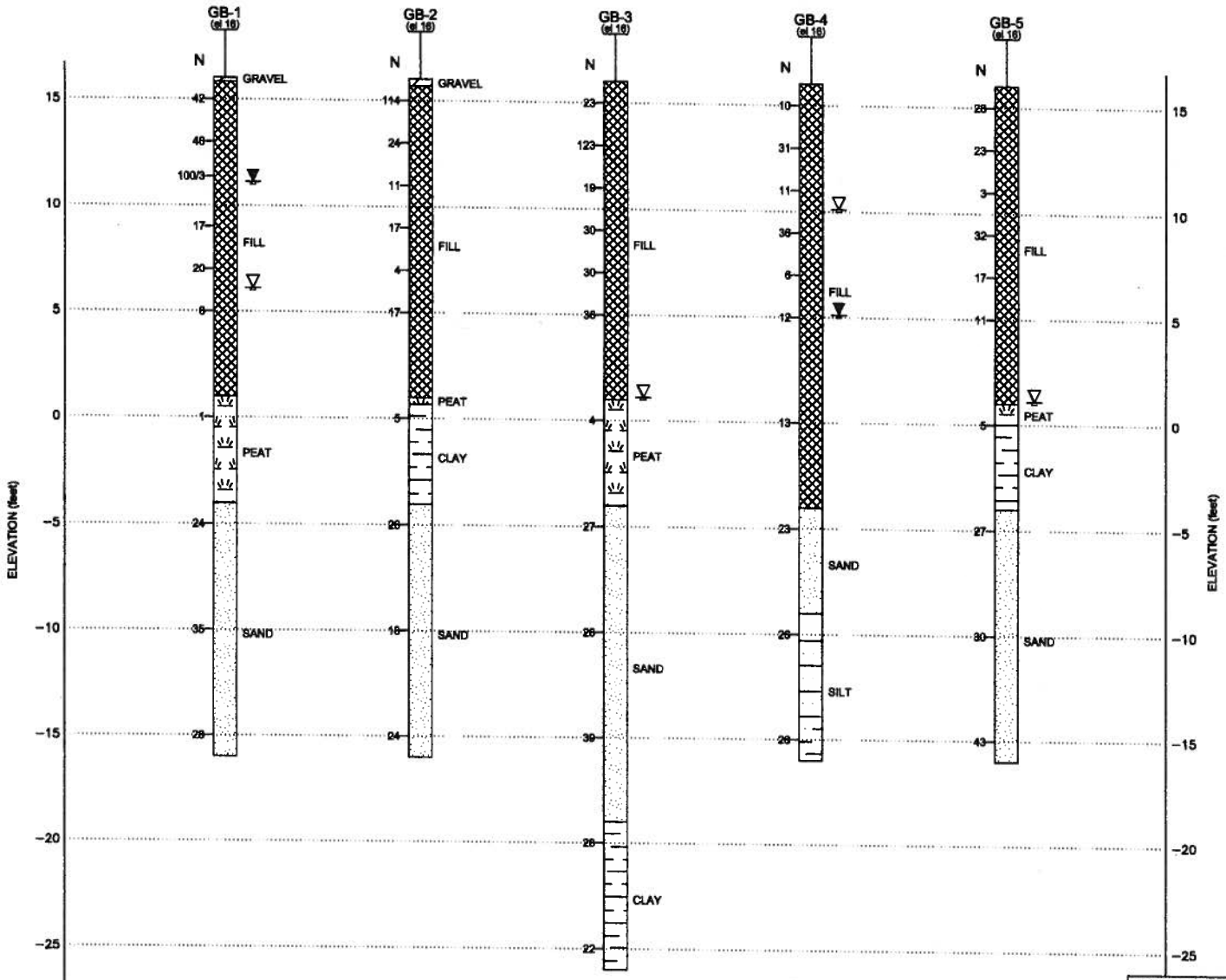
1. PROPOSED PARKING LOT OUTLINE WAS REPRODUCED FROM THE DRAWING TITLED "CONCEPTUAL LAYOUT 'A'" PREPARED BY JACOBS ENGINEERING GROUP, INC., DATED 27 MARCH 2008.
2. ALL BORING LOCATIONS ARE APPROXIMATE.
3. ALL GB-# BORINGS WERE COMPLETED BY WARREN GEORGE, INC., BETWEEN 22 AND 23 APRIL 2009 UNDER THE DIRECT SUPERVISION OF GZA GEOENVIRONMENTAL, INC.
4. FOR SUBSURFACE CONDITIONS ENCOUNTERED IN THE BORINGS, REFER TO SUBSURFACE PROFILE PRESENTED ON FIGURE 3.

PROPOSED PARKING LOT

168-354 FRONTAGE ROAD, NEWARK, NEW JERSEY

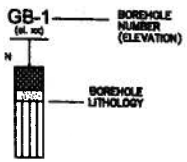
LOCATION PLAN

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists, 95 LAKE ROAD, 4TH FLOOR, HAMPSTEAD, NEW JERSEY 03841, (973) 774-0000		PREPARED FOR: JACOBS ENGINEERING GROUP, INC	
FROM MBN: GK	REVIEWED BY: GK	CHECKED BY: GK	FIGURE NO. 2
DESIGNED BY:	DRAWN BY: DVT	SCALE: 1"=40'	
DATE: 5/4/2009	PROJECT NO. 12.0075892.00	REVISION NO.	



SECTION A-A
V.SCALE: 1"=5'
H. SCALE: NTS

BORING KEY:



LEGEND:

GB-#	GZA BORING IDENTIFICATION
el. XX	INFERRED GROUND SURFACE ELEVATION AT TIME OF BORING
N	STANDARD PENETRATION RESISTANCE; NUMBER OF BLOWS OF A 140 LB SAFETY HAMMER FREE FALLING 30 INCHES TO DRIVE A 2-INCH-O.D. SPLIT SPOON SAMPLER 12 INCHES AFTER 6 INCHES OF INITIAL PENETRATION.
▽	WATER LEVEL READING (INITIAL)
▼	WATER LEVEL READING (COMPLETION)

NOTES:

1. THIS PROFILE SHOWS GENERALIZED SUBSURFAE CONDITIONS AT BORING LOCATIONS. VARIATIONS IN SUBSURFACE CONDITIONS SHOULD BE EXPECTED BETWEEN BORINGS.
2. BORING ELEVATIONS ARE APPROXIMATE AND INFERRED FROM THE UNITED STATES GEOLOGIC SURVEY (USGS) 7.5 MINUTE TOPOGRAPHIC QUADRANGLE MAP, ELIZABETH, NEW JERSEY, 1981.
3. ELEVATIONS REFERENCED TO THE NORTH AMERICAN DATUM OF 1927 (NAD27).
4. BORINGS GB-1 THROUGH GB-5 WERE COMPLETED BY WARREN GEORGE, INC BETWEEN 22 AND 23 APRIL 2009 UNDER DIRECT SUPERVISION OF GZA GEOENVIRONMENTAL, INC.
5. FOR DETAILED DESCRIPTIONS OF SUBSURFACE CONDITIONS ENCOUNTERED, SEE BORING LOGS IN APPENDIX B.

PROPOSED PARKING LOT

168-354 FRONTAGE ROAD, NEWARK, NEW JERSEY

SUBSURFACE PROFILE

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists
PREPARED FOR: JACOBS ENGINEERING GROUP, INC

PROJ. MGR. GK	REVIEWED BY GK	CHECKED BY GK	FIGURE NO.
DESIGNED BY	DRAWN BY CNY	SCALE AS SHOWN	3
DATE 5/4/2009	PROJECT NO. 12.0075892.00	REVISION NO.	

TABLES

Table 1: Recommended Use and Gradation Criteria for Fill Materials

USE OF FILL MATERIAL

Granular Fill:	Below footings and slabs base course, and 3 feet laterally behind walls provided that amount passing Sieve No. 200 is less than 8 percent.
Sand-Gravel:	Slab base course and 3 feet laterally behind walls
Crushed Stone:	Drain line backfill and foundation protective layer

GRADATION REQUIREMENTS

Sieve Size	**Percent Finer by Weight**
Granular Fill — Shall be free from ice and snow, roots, sod, rubbish and other deleterious or organic matter. Granular Fill shall conform to the following gradation requirements:	
4" to 6"	100
No. 10	30 – 95
No. 40	10 – 70
No. 200	*0 – 15 *0 – 8 where used behind walls
Sand-Gravel — Shall consist of durable sand and gravel and shall be free from ice and snow, roots, sod, rubbish and other deleterious or organic matter. Sand-Gravel shall conform to the following gradation requirements:	
3 inch	100
½ inch	50 – 85
No. 4	40 – 75
No. 40	10 – 35
No. 200	0 – 8
Crushed Stone — Shall consist of durable crushed rock or durable crushed gravel stone and shall be free from ice and snow, roots, sod, rubbish and other deleterious or organic matter or material. Crushed Stone shall conform to the following gradation requirements:	
1 inch	100
¾ inch	90 – 100
½ inch	10 – 50
3/8 inch	0 – 20
No. 4	0 – 5
No. 200	0 – 1

Table 2: Compaction Methods

Compaction Method	Max. Stone Size*	Maximum Loose Lift Thickness		Minimum Number of Passes	
		Below Structures and Pavement	Less Critical Area	Below Structures and Pavement	Less Critical Area
GRANULAR FILL, SAND-GRAVEL FILL, CRUSHED STONE					
Hand-operated vibratory plate or light roller in confined areas	4"	6"	8"	4	4
Hand-operated vibratory drum rollers weighing at least 1,000# in confined areas	6"	10"	12"	4	4
Light vibratory drum roller Min. weight at drum 3000# Min dynamic force 10,000#	8"	12"	18"	4	4
Medium vibratory drum roller Min. weight at drum 10,000# Min dynamic force 20,000#	8"	18"	24"	6	6

B

Appendix A

GEOTECHNICAL LIMITATIONS

GEOTECHNICAL LIMITATIONS

Explorations

1. The analyses and recommendations submitted in this report are based in part upon the data obtained from subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the boring logs.

3. Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors occurring since the time measurements were made.

Review

4. In the event that any changes in the nature, design or location of the proposed parking lot are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by GZA GeoEnvironmental, Inc. (GZA). It is recommended that this firm be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications.

Construction

5. It is recommended that this firm be retained to provide soil engineering services during site excavation and grading phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

Use of Report

6. This report has been prepared for the exclusive use of **Jacobs Engineering Group, Inc and the New Jersey Department of Property Management and Construction** for specific application to the proposed construction activities located at **168-354 Frontage Road in Newark, New Jersey**, in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made.

Appendix B

BORING LOGS

GZA
GeoEnvironmental, Inc.

Boring Log **GB-1**

Sheet 1 of 2

Project: Proposed Parking Lot		Location: 168-354 Frontage Road, Newark, NJ	
Project No.: 12.0075892.00		Client: Jacobs Engineering Group, Inc	
Drilling Company: Warren George, Inc		Elevation and Datum: Approx. 16 (NAD27)	
Drilling Equipment: CME-55	Drilling Method: Mud Rotary	Date Started: 4/22/09	Date Finished: 4/22/09
Sampler: 2" O.D. Split Spoon Sampler		Final Boring Depth: 32 ft	Depth to Rock: N.E.
Sampler Hammer: Donut	Weight (lbs): 140 / Drop (in): 30	Groundwater Depth (ft): Initial ▽ 10	Completion ▼ 5 / 24 Hours ▼ 3.5
Drilling Foreman: Dion Dewer		GZA Inspector: Oleg Tkachenko	Checked By: GK

Depth (ft)	Sample Description	Elev. (ft)	Material Symbol	Sample Data: Number	Type	Recov. (in)	Penetr. resist Bl/6in	N-Value (Blows/foot)	Remarks
0	(2") Gray crushed STONE	+16.0							Driller setup and started drilling at GB-1 on 4/22/09 at 11:30 AM.
	Brown f-m SAND, some Silt, trace f. Gravel, trace Glass and Brick fragments (moist) [FILL]	+15.8		S-1	SS	19	38 25 17 15	42	
2	Dark brown f-m SAND, some Silt, trace Plastic and Wood fragments (moist) [FILL]			S-2	SS	4	12 20 26 65	46	
4	Brown f-m SAND, some Silt, trace f. Gravel, trace Concrete and Brick fragments (moist) [FILL]			S-3	SS	12	70 60 100/3	Refusal	Advanced casing to 4'. Drilled to 4'.
									Drill rig chatering from 5'-3" to 5'-10".
6	Brown f-m SAND, some Silt, trace f. Gravel, trace Wood and Plastic fragments (moist) [FILL]			S-4	SS	8	16 8 9 9	17	Drilled to 6'.
8	Brown SILT, some f-c Sand, trace f. Gravel, trace Brick fragments (moist) [FILL]			S-5	SS	10	6 10 10 22	20	
10	Brown CLAY, trace f-m Sand, trace f. Gravel, trace Wood fragments (wet) [FILL]			S-6	SS	12	3 3 3 4	6	Drilled to 10'. q_u = 0.75 tsf
15	Dark brown PEAT (wet)	+1.0		S-7	SS	16	2 0 1 2	1	Drilled to 15'.
20		-4.0							

J:\75875 TO 75899\75892, FRONTAGE RD, NEWARK\GEOTECHNICAL\DATA AND ANALYSES\12.0075892.00.GPJ ... 4/29/2009 10:25:16 AM ... Report: Log - NJ-GZA_GEO ...Template TEMPLATE.GDT

GZA
GeoEnvironmental, Inc.

Boring Log **GB-1**

Sheet 2 of 2

Project: Proposed Parking Lot	Location: 168-354 Frontage Road, Newark, NJ
Project No.: 12.0075892.00	Client: Jacobs Engineering Group, Inc
Drilling Company: Warren George, Inc	Elevation and Datum: Approx. 16 (NAD27)

Depth (ft)	Sample Description	Elev. (ft)	Material Symbol	Sample Data: Number	Type	Recov. (in)	Penetr. resist Bl/6in	N-Value (Blows/foot) 10 20 30 40	Remarks
20	Light brown f-m SAND, trace Silt (wet)			S-8	SS	18	11 12 12 10	24	Drilled to 20'.
25	Reddish brown f-m SAND, trace Silt (wet)			S-9	SS	18	13 16 19 20	35	Drilled to 25'.
30	Reddish brown f. SAND, some Silt (wet)			S-10	SS	16	13 13 15 17	28	Drilled to 30'.
32		-16.0							
	End of GB-1 at 32'-0".								Driller backfilled the borehole upon completion using drill cuttings.
42									

J:\75875 TO 75899\75892, FRONTAGE RD, NEWARK\GEOTECHNICAL\DATA AND ANALYSES\12.0075892.00.GPJ ... 4/29/2009 10:25:16 AM ... Report: Log - NJ-GZA_GEO ...Template TEMPLATE.GDT

GZA
GeoEnvironmental, Inc.

Boring Log **GB-2**

Sheet 1 of 2

Project: Proposed Parking Lot		Location: 168-354 Frontage Road, Newark, NJ	
Project No.: 12.0075892.00		Client: Jacobs Engineering Group, Inc	
Drilling Company: Warren George, Inc		Elevation and Datum: Approx. 16 (NAD27)	
Drilling Equipment: CME-55	Drilling Method: Mud Rotary	Date Started: 4/22/09	Date Finished: 4/22/09
Sampler: 2" O.D. Split Spoon Sampler		Final Boring Depth: 32 ft	Depth to Rock: N.E.
Sampler Hammer: Donut	Weight (lbs): 140 / Drop (in): 30	Groundwater Depth (ft): Initial ▽ -	Completion ▼ - / 24 Hours ▼ -
Drilling Foreman: Dion Dewer		GZA Inspector: Oleg Tkachenko	Checked By: GK

Depth (ft)	Sample Description	Elev. (ft)	Material Symbol	Sample Data: Number	Type	Recov. (in)	Penetr. resist Bl/6in	N-Value (Blows/foot)	Remarks
0	(4") Gray crushed STONE	+16.0							
1	Brown f-m SAND, some Silt, trace f. Gravel, trace Concrete and Brick fragments (moist) [FILL]	+15.7		S-1	SS	16	13, 54, 60, 65	114	Driller setup and started drilling at GB-2 on 4/22/09 at 3:05 PM.
2	Dark gray CLAY, some f-m Sand, trace f. Gravel, trace Plastic and Brick fragments (wet) [FILL]			S-2	SS	4	17, 8, 16, 7	24	Drilled to 2'.
3									
4	Brown f-c SAND, some Silt, trace Plastic, Wood and Brick fragments (wet) [FILL]			S-3	SS	8	4, 5, 6, 27	11	Advanced casing to 4'. Drilled to 4'.
5									
6	Black f. GRAVEL, trace Silt, trace Brick fragments (wet) [FILL]			S-4	SS	2	21, 8, 9, 9	17	
7									
8	Light gray to Brown f-m SAND, some Silt, trave f. Gravel, trace Wood fragments (wet) [FILL]			S-5	SS	13	6, 2, 2, 4	4	Drilled to 8'.
9									
10	Black SILT, some f-m Sand, trace Clay, trace Wood fragments (wet) [FILL]			S-6	SS	10	6, 9, 8, 6	17	
11									
12									
13									
14									
15	Dark brown PEAT (wet)	+1.0		S-7A					Drilled to 15'.
16	Gray CLAY, trace Fibers (wet)	+0.7		S-7B	SS	10	3, 2, 3, 6	5	
17									
18									
19									
20		-4.0							

J:\75875 TO 75899\75892, FRONTAGE RD, NEWARK\GEOTECHNICAL\DATA AND ANALYSES\12.0075892.00.GPJ ... 4/29/2009 10:25:21 AM ... Report: Log - NJ-GZA_GEO ...Template TEMPLATE.GDT

GZA
GeoEnvironmental, Inc.

Boring Log **GB-2**

Sheet 2 of 2

Project: Proposed Parking Lot	Location: 168-354 Frontage Road, Newark, NJ
Project No.: 12.0075892.00	Client: Jacobs Engineering Group, Inc
Drilling Company: Warren George, Inc	Elevation and Datum: Approx. 16 (NAD27)

Depth (ft)	Sample Description	Elev. (ft)	Material Symbol	Sample Data: Number	Type	Recov. (in)	Penetr. resist Bl/6in	N-Value (Blows/foot) 10 20 30 40	Remarks
20	Reddish brown f-m SAND, trace Silt (wet)			S-8	SS	13	4 10 16 17	26	Drilled to 20'.
25	Reddish brown f-m SAND, trace Silt (wet)			S-9	SS	10	8 8 10 12	18	Drilled to 25'.
30	Reddish brown f. SAND, some Silt (wet)			S-10	SS	14	9 12 12 16	24	Drilled to 30'.
32	End of GB-2 at 32'-0".	-16.0							Driller backfilled the borehole upon completion using drill cuttings.
42									

J:\75875 TO 75899\75892, FRONTAGE RD, NEWARK\GEOTECHNICAL\DATA AND ANALYSES\12.0075892.00.GPJ ... 4/29/2009 10:25:22 AM ... Report: Log - NJ-GZA_GEO ...Template TEMPLATE.GDT

GZA GeoEnvironmental, Inc.

Boring Log **GB-3**

Sheet 1 of 2

Project: Proposed Parking Lot		Location: 168-354 Frontage Road, Newark, NJ	
Project No.: 12.0075892.00		Client: Jacobs Engineering Group, Inc	
Drilling Company: Warren George, Inc		Elevation and Datum: Approx. 16 (NAD27)	
Drilling Equipment: CME-55	Drilling Method: Mud Rotary	Date Started: 4/23/09	Date Finished: 4/23/09
Sampler: 2" O.D. Split Spoon Sampler		Final Boring Depth: 42 ft	Depth to Rock: N.E.
Sampler Hammer: Donut	Weight (lbs): 140 / Drop (in): 30	Groundwater Depth (ft): Initial ▽ 15	Completion ▼ - / 24 Hours ▼ -
Drilling Foreman: Dion Dewer		GZA Inspector: Oleg Tkachenko	Checked By: GK

Depth (ft)	Sample Description	Elev. (ft)	Material Symbol	Sample Data: Number	Type	Recov. (in)	Penetr. resist Bl/6in	N-Value (Blows/foot)	Remarks
0	Brown f-m SAND, some Silt, trace Concrete and Brick fragments (moist) [FILL]	+16.0		S-1	SS	14	9 11 12 12	23	Driller setup and started drilling at GB-3 on 4/23/09 at 11:10 AM.
2	Dark brown f-m SAND, some Silt, trace f. Gravel, trace Plastic, Brick and Stirofoam fragments (moist) [FILL]			S-2	SS	15	7 40 83 45	123	
4	Brown to Black f-m SAND, some Silt, trace Clay, trace Wood fragments (moist) [FILL]			S-3	SS	5	17 11 8 8	19	Advanced casing to 4'. Drilled to 4'.
6	Brown f-m SAND, some Silt, trace Glass fragments (moist) [FILL]			S-4	SS	13	10 10 20 22	30	
8	Brown f-m SAND, some Silt, trace Glass, Asphalt and Brick fragments (moist) [FILL]			S-5	SS	8	7 8 22 48	30	Drilled to 8'.
10	Dark brown f-m SAND, some Silt, trace f. Gravel, trace Brick and Wood fragments (moist) [FILL]			S-6	SS	13	20 18 18 19	36	
12									
14									
▽		+1.0							
15	Dark brown PEAT (wet)			S-7	SS	3	3 1 3 3	4	Drilled to 15'.
16									
18									
20	Light brown f-m SAND, trace Silt (wet)	-4.0		S-8	SS	17	11 14 13 10	27	Drilled to 20'.
22									
24									
26	Reddish brown f-m SAND, trace Silt (wet)			S-9	SS	16	13 13 13 13	26	Drilled to 25'.
28									
30									

J:\75875 TO 75899\75892, FRONTAGE RD, NEWARK\GEOTECHNICAL\DATA AND ANALYSES\12.0075892.00.GPJ ... 4/29/2009 10:25:27 AM ... Report: Log - NJ-GZA_GEO ...Template TEMPLATE.GDT

GZA
GeoEnvironmental, Inc.

Boring Log **GB-3**

Sheet 2 of 2

Project: Proposed Parking Lot	Location: 168-354 Frontage Road, Newark, NJ
Project No.: 12.0075892.00	Client: Jacobs Engineering Group, Inc
Drilling Company: Warren George, Inc	Elevation and Datum: Approx. 16 (NAD27)

Depth (ft)	Sample Description	Elev. (ft)	Material Symbol	Sample Data: Number	Type	Recov. (in)	Penetr. resist Bl/6in	N-Value (Blows/foot) 10 20 30 40	Remarks
30	Reddish brown f. SAND, trace Silt (wet)			S-10	SS	20	12 18 21 15	39	Drilled to 30'.
32									
34		-18.0							
36	Reddish brown CLAY, trace f. Sand, trace Silt (wet)			S-11	SS	20	16 14 14 19	28	Drilled to 35'. q_u = 2.0 tsf
38									
40	Reddish brown CLAY, trace Silt (wet)			S-12	SS	22	8 8 14 14	22	Drilled to 40'. q_u = 1.75 tsf
42		-26.0							
44	End of GB-3 at 42'-0".								Driller backfilled the borehole upon completion using drill cuttings.
46									
48									
50									
52									
54									
56									
58									
60									
62									
63									

J:\75875 TO 75899\75892_FRONTAGE RD, NEWARK\GEOTECHNICAL\DATA AND ANALYSES\12.0075892.00.GPJ ... 4/29/2009 10:25:27 AM ... Report: Log - NJ-GZA_GEO ...Template TEMPLATE.GDT

GZA GeoEnvironmental, Inc.

Boring Log **GB-4**

Sheet 1 of 2

Project: Proposed Parking Lot		Location: 168-354 Frontage Road, Newark, NJ	
Project No.: 12.0075892.00		Client: Jacobs Engineering Group, Inc	
Drilling Company: Warren George, Inc		Elevation and Datum: Approx. 16 (NAD27)	
Drilling Equipment: CME-55	Drilling Method: Mud Rotary	Date Started: 4/23/09	Date Finished: 4/23/09
Sampler: 2" O.D. Split Spoon Sampler		Final Boring Depth: 32 ft	Depth to Rock: N.E.
Sampler Hammer: Donut	Weight (lbs): 140 / Drop (in): 30	Groundwater Depth (ft): Initial ▽ 6	Completion ▼ 11 / 24 Hours ▼ -
Drilling Foreman: Dion Dewer		GZA Inspector: Oleg Tkachenko	Checked By: GK

Depth (ft)	Sample Description	Elev. (ft) +16.0	Sample Data: Number	Type	Recov. (in)	Penetr. resist Bl/6in	N-Value (Blows/foot)	Remarks
0	Brown f-c SAND, some Silt, trace f. Gravel, trace Brick fragments (moist) [FILL]		S-1	SS	13	3 4 6 8	10	Driller setup and started drilling at GB-4 on 4/23/09 at 8:15 AM.
2	Reddish brown SANDSTONE fragments (moist) [FILL]		S-2	SS	1	14 12 19 13	31	
4	No Recovery		S-3	SS	0	7 6 5 4	11	Advanced casing to 4'. Drilled to 4'.
6	Brown f-m SAND, some Silt, trace f. Gravel, trace Brick and Sandstone fragments (wet) [FILL] ▽		S-4	SS	16	14 20 16 11	36	
8	Brown f-m SAND, some Silt, trace Brick and Wood fragments (wet) [FILL]		S-5	SS	7	6 4 2 8	6	Drilled to 8'.
10	No Recovery ▼		S-6	SS	0	6 5 7 7	12	
12								Loosing mud from 13' to 15'.
14								Advanced casing to 14'.
15	Gray f. GRAVEL (wet) [FILL]		S-7	SS	3	8 5 8 15	13	Drilled to 15'.
16								Drill rig chatering at 16'.
19		-4.0						Advanced casing to 19'.
20								

J:\75875 TO 75899\75892, FRONTAGE RD, NEWARK\GEOTECHNICAL\DATA AND ANALYSES\12.0075892.00.GPJ ... 4/29/2009 10:25:32 AM ... Report: Log - NJ-GZA_GEO ...Template TEMPLATE.GDT

GZA
GeoEnvironmental, Inc.

Boring Log **GB-4**

Sheet 2 of 2

Project: Proposed Parking Lot	Location: 168-354 Frontage Road, Newark, NJ
Project No.: 12.0075892.00	Client: Jacobs Engineering Group, Inc
Drilling Company: Warren George, Inc	Elevation and Datum: Approx. 16 (NAD27)

Depth (ft)	Sample Description	Elev. (ft)	Material Symbol	Sample Data: Number	Type	Recov. (in)	Penetr. resist Bl/6in	N-Value (Blows/foot)	Remarks
20	Reddish brown f. SAND, some Silt (wet)			S-8	SS	16	3 9 14 16	23	Drilled to 20'.
25	Reddish brown SILT, trace f. Sand, trace Clay (wet)	-9.0		S-9	SS	19	9 10 16 18	26	Drilled to 25'. q_u = 4.5 tsf
30	Reddish brown SILT, Some Fine Sand (wet)			S-10	SS	13	6 12 14 13	26	Drilled to 30'.
32	End of GB-4 at 32'-0".	-16.0							Driller backfilled the borehole upon completion using drill cuttings.

J:\75875 TO 75899\75892, FRONTAGE RD, NEWARK\GEOTECHNICAL\DATA AND ANALYSES\12.0075892.00.GPJ ... 4/29/2009 10:25:32 AM ... Report: Log - NJ-GZA_GEO ...Template TEMPLATE.GDT

GZA
GeoEnvironmental, Inc.

Boring Log **GB-5**

Sheet 1 of 2

Project: Proposed Parking Lot		Location: 168-354 Frontage Road, Newark, NJ	
Project No.: 12.0075892.00		Client: Jacobs Engineering Group, Inc	
Drilling Company: Warren George, Inc		Elevation and Datum: Approx. 16 (NAD27)	
Drilling Equipment: CME-55	Drilling Method: Mud Rotary	Date Started: 4/23/09	Date Finished: 4/23/09
Sampler: 2" O.D. Split Spoon Sampler		Final Boring Depth: 32 ft	Depth to Rock: N.E.
Sampler Hammer: Donut	Weight (lbs): 140 / Drop (in): 30	Groundwater Depth (ft): Initial ▽ 15	Completion ▼ - / 24 Hours ▼ -
Drilling Foreman: Dion Dewer		GZA Inspector: Oleg Tkachenko	Checked By: GK

Depth (ft)	Sample Description	Elev. (ft)	Material Symbol	Sample Data: Number	Type	Recov. (in)	Penetr. resist Bl/6in	N-Value (Blows/foot)	Remarks
0	Brown f-c SAND, some Silt, trace Brick and Asphalt fragments (moist) [FILL]	+16.0		S-1	SS	13	11, 19, 9, 4	28	Driller setup and started drilling at GB-5 on 4/23/09 at 1:25 PM.
2	Brown SILT, trace f-m Sand, trace Glass fragments (moist) [FILL]			S-2	SS	2	8, 6, 17, 26	23	Organic odor.
4	Brown f-m SAND, some Silt, trace Wood, Plastic and Glass fragments (wet) [FILL]			S-3	SS	6	11, 1, 2, 2	3	Advanced casing to 4'. Drilled to 4'.
6	Brown f-m SAND, some Silt, trace Brick and Wood fragments (wet) [FILL]			S-4	SS	12	9, 13, 19, 12	32	
8	Brown f-m SAND, some Silt, trace f. Gravel, trace Brick fragments (moist) [FILL]			S-5	SS	6	4, 12, 5, 5	17	Drilled to 8'.
10	Brown f-m SAND, some Silt, trace f. Gravel, trace Glass and Wood fragments (moist) [FILL]			S-6	SS	12	1, 5, 6, 8	11	
15	Brown PEAT (wet) ▽	+1.0		S-7A	SS	20	2, 2, 3, 3	5	Drilled to 15'.
16	Ligth gray CLAY, trace Fibers (wet)	0.0		S-7B					q_u = 0.5 tsf
20		-4.0							

J:\75875 TO 75899\75892, FRONTAGE RD, NEWARK\GEOTECHNICAL\DATA AND ANALYSES\12.0075892.00.GPJ ... 4/29/2009 10:25:37 AM ... Report: Log - NJ-GZA_GEO ...Template TEMPLATE.GDT

GZA
GeoEnvironmental, Inc.

Boring Log **GB-5**

Sheet 2 of 2

Project: Proposed Parking Lot	Location: 168-354 Frontage Road, Newark, NJ
Project No.: 12.0075892.00	Client: Jacobs Engineering Group, Inc
Drilling Company: Warren George, Inc	Elevation and Datum: Approx. 16 (NAD27)

Depth (ft)	Sample Description	Elev. (ft)	Material Symbol	Sample Data: Number	Type	Recov. (in)	Penetr. resist Bl/6in	N-Value (Blows/foot) 10 20 30 40	Remarks
20	Light brown f-m SAND, trace Silt (wet)			S-8	SS	17	13, 14, 13, 17	27	Drilled to 20'.
25	Reddish brown f-m SAND, trace Silt (wet)			S-9	SS	17	15, 14, 16, 19	30	Drilled to 25'.
30	Reddish brown f. SAND, trace Silt (wet)			S-10	SS	17	16, 20, 23, 25	43	Drilled to 30'.
32	End of GB-5 at 32'-0".	-16.0							Driller backfilled the borehole upon completion using drill cuttings.

J:\75875 TO 75899\75892, FRONTAGE RD, NEWARK\GEOTECHNICAL\DATA AND ANALYSES\12.0075892.00.GPJ ... 4/29/2009 10:25:38 AM ... Report: Log - NJ-GZA_GEO ...Template TEMPLATE.GDT